



Artificial Intelligence Talent in Canada

Emerging AI Skills and Future Workforce





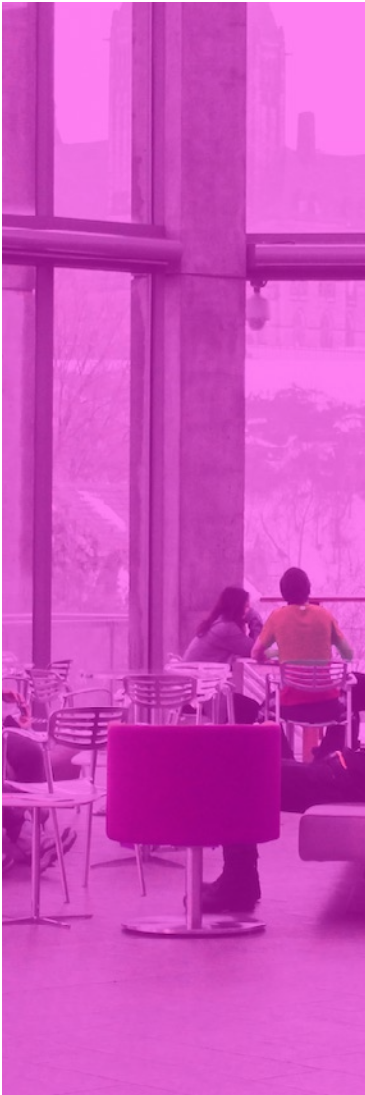
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The Vector Institute, a leader in artificial intelligence research and application, is at the forefront of fostering AI talent in Canada. Established with a vision to drive excellence in AI knowledge creation and use, Vector plays a pivotal role in building a world-class community of AI researchers and practitioners.

By focusing on deep learning and machine learning, Vector not only advances cutting-edge research but also cultivates the next generation of AI professionals, positioning Canada as a global leader in AI innovation and talent development. Vector's commitment to talent development is also evident in its efforts to attract top global researchers and support a vibrant, innovative problem-solving environment. The institute collaborates with industry and public institutions to ensure they have the skilled workforce needed to excel in AI implementation.

To learn more about the Vector Institute, visit us at vectorinstitute.ai



Future Skills Centre Centre des **Compétences futures**

The Future Skills Centre – Centre des Compétences futures (FSC-CCF) is a forward-thinking centre for research and collaboration dedicated to preparing Canadians for employment success. We believe Canadians should feel confident about the skills they have to succeed in a changing workforce. As a pan-Canadian community, we are collaborating to rigorously identify, test, measure, and share innovative approaches to assessing and developing the skills Canadians need to thrive in the days and years ahead.

The Future Skills Centre was founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada.

If you would like to learn more about this report and other skills research from FSC, visit us at fsc-ccf.ca or contact info@fsc-ccf.ca.

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Contents

6

About this project

7

Key findings

8

Advancing AI in Canada

11

AI talent insights

19

**Strategies to retain Canada's
AI talent**

20

Recommendations

22

**Appendix A
Methodology**

24

**Appendix B
Detailed tables**

26

**Appendix C
Bibliography**

About this project

The Canadian AI Talent project was funded by the Vector Institute and the Future Skills Centre. The Vector Institute's mandate is to empower researchers, businesses, and governments to develop and adopt AI responsibly.

The Canadian AI Talent project was developed to better understand and help address the challenges with building a workforce in Canada able to leverage and drive AI adoption for Canadian businesses to succeed at home and globally.

This impact paper provides targeted insights from organizations actively developing and using AI to improve Canada's AI skill-development initiatives. The report encompasses efforts to pinpoint challenges in recruiting essential AI roles and evaluate skills gaps. We conducted in-depth interviews, organized roundtables, sought expert opinions, and analyzed job market data from Vicinity Jobs for a comprehensive understanding of the AI skills landscape.¹

¹ See Appendix A for more details.

Key findings

- There is a shift in the Canadian AI job market toward more specialized, core AI skills— skills that are only and directly applicable to developing and using AI technologies. The demand for core AI skills increased by 37.0 per cent from 2018 to 2023. In contrast, the demand for peripheral AI skills—those critical to the use of AI but may also be used in other contexts—decreased by 46.4 per cent. Both core and peripheral AI skills consist of knowledges and technical abilities.
- Technical talent, usually at the PhD or MA level, is considered table stakes for businesses to be competitive in the AI market. Organizations need talent that has a deep technical background either in AI or hard sciences, and businesses highly value non-technical skills such as creativity, curiosity, problem-solving, communication, an engineering mindset, and business acumen.
- Canadian start-ups and scale-ups developing AI products need senior and specialized employees. These companies face constraints in hiring more junior talent because they don't have the time and/or capacity to develop AI talent to know how to solve the early challenges of a start-up/scale-up. They told us they are frequently losing their bid for senior and specialized workers to competitors in Canada and the U.S., often due to compensation.
- In contrast, larger Canadian organizations in AI-adjacent spaces from sectors including health, retail, and transportation have indicated they often do not face challenges in attracting talent, but face challenges in adopting AI such as pushback due to costs and a lack of AI literacy amongst decision-makers.
- In the U.S. interviews, it became clear that rapid AI adoption among businesses and the R&D conducted at the world's largest AI companies creates a different hiring environment than in Canada. These higher levels of adoption and massive investments in AI systems have created an AI talent shortage in that country. We heard of a scarcity of PhDs with deep AI skills.
- AI literacy, from the C-suite to all employees is seen as a core issue in advancing Canada's lagging AI adoption.

Advancing AI in Canada

Canada has been a leader in the research and development of artificial intelligence (AI) for decades.² Ontario boasts the world's third-highest concentration of AI researchers, solidifying Canada's position as a leading international centre for AI.³

We outperform G7 peers in the growth rate of AI talent concentration, the number of women in AI roles, and per capita published AI research.⁴ Early investments in the Pan-Canadian Artificial Intelligence Strategy, AI R&D, and talent are paying dividends. However, where we struggle as a nation is in AI adoption.⁵ A lack of capital investment and adoption of new technologies is a perennial challenge in Canada.⁶

Canada has demonstrated it can produce best-in-class AI talent. What will it take to preserve that edge in the future?

To identify a path forward and illuminate the challenges we face in Canada, we spoke to 46 business leaders in Canada and the United States to get their perspectives on where AI hiring and talent is headed.

Canada's AI ecosystem is vast. To cover all dimensions, we intentionally reached out to senior technical leaders and executives from Canadian organizations who represented start-ups, scale-ups, and larger enterprises. We spoke with leaders whose businesses have AI at the centre and businesses

that are AI-adjacent. A total of 31 Canadian-based interviews, representing 16 AI-first organizations and 15 AI-adjacent organizations, were conducted.⁷

Since the U.S. has twice our adoption rate⁸ and is home to the largest AI investments,⁹ we also spoke to U.S.-based companies. We wanted to know what the leading edge of AI talent and skills looks like from U.S. tech giants, consultants, venture capitalists, and Silicon Valley AI start-ups. Given that many of the global tech giants and AI companies are based there, the U.S. offers a window into where the AI landscape might be heading – and a direction Canada could take to catch up. We conducted 15 U.S.-based interviews, including six AI-first organizations and nine AI-adjacent organizations.

The interviewees hold roles such as Heads of Data Science, Chief AI Officers, Managing Directors of Enterprise Data and AI, co-CEOs, and Chief Scientists. They represent diverse industries, including finance and banking, energy, transportation, cybersecurity, music, fintech, HR technology, consulting, real estate, and the public sector.

2 Khoury, "Artificial Intelligence in Canada."

3 Vector Institute, *Helping Canada Win at AI*.

4 Deloitte, "Canada Leads the World in AI Talent Concentration."

5 Royal Bank of Canada, GenAI; Canadian Chamber of Commerce, Prompting Productivity.

6 Conference Board of Canada, *The, 2024 Innovation Report Card*.

7 AI-first refers to those organizations who are at the cutting-edge of developing, adapting, and adopting AI tools, policies, and best practices. AI-adjacent are organizations that have adopted AI to enhance their existing products or services but are not focused on developing AI technologies.

8 KPMG, "More Than One Third of Canadian Businesses Experimenting with ChatGPT."

9 Maslej and others, *The AI Index 2024 Annual Report*.

Demand for AI roles and AI skills

Skills constitute discrete knowledge and technology-based competencies that enable employees to do their work. Different but related skill sets are combined into specific roles for AI professionals. We distinguish between two types of AI roles that play critical¹⁰ and supporting roles,¹¹ respectively, in the development of AI systems and applications.

Demand for *critical* AI roles, which include positions like data scientists, technical product managers, AI/ML (machine learning) scientists, and researchers peaked in 2022 before it declined in 2023. Demand for *supporting* AI roles such as software developers/programmers and software engineers/designers declined. (See Chart 1.) This is partially due to the decline in overall job postings in the Canadian economy. Job postings in general declined by 16.0 per cent from 2022 to 2023 while job postings for AI roles declined by 35.0 per cent over the same period.¹²

The decline in postings for AI roles in 2023 is not unique to Canada. The Stanford AI Index Report 2024 found AI job postings declined in most countries in 2023. The recent decrease in demand for AI roles could be due to a combination of factors. A high-interest rate environment is likely making businesses more cautious in terms of investing in new technological capabilities. It could also reflect companies' maturing approach to AI implementation and their focus on translating AI capabilities into tangible outcomes. Overall, it remains to be seen whether the recent slowdown in hiring for critical AI roles in 2023 is a temporary phenomenon or a sign of more structural changes in the labour market.

The declining trend in supporting AI roles is largely driven by the sharp drop in demand for software developers/programmers and software engineers/designers. The increasing integration of AI tools in

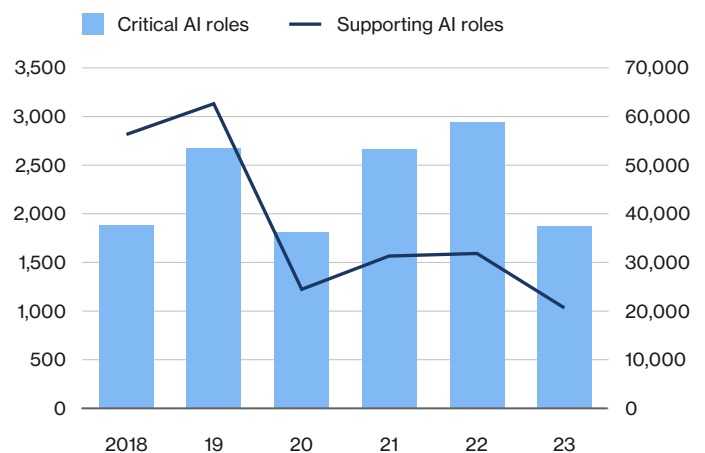
software development processes might be reducing the need for traditional coding roles while simultaneously growing demand for professionals who can work with and optimize AI-enhanced development tools.^{13,14} Database analyst was the only peripheral AI role for which demand increased from 2018 to 2023. The growth in database analyst positions amid overall decline in supporting AI hiring suggests a rising importance of data management and optimization due to the data-intensive nature of AI systems and applications.¹⁵

Roles reveal only part of the labour market picture. Analyzing the demand for specific skills within AI roles reveals deeper insights into emerging hiring trends.

Chart 1

Demand for AI roles, 2018–2023

(left axis: number of job postings for 6 critical AI roles; right axis: number of job postings for 7 supporting AI roles)



Sources: The Conference Board of Canada; Vicinity Jobs.

¹⁰ Critical AI roles are those where at least one core AI skill is referenced in at least 50.0 per cent of the job postings and at least one of the core AI skills is clustered within them over the 2022–2023 period. There are six critical AI roles: AI/ML scientists/researchers, ML Ops engineers, technical product managers, statistical officers and related research support occupations, business intelligence analysts, and data scientists.

¹¹ Supporting AI roles are those where at least one core AI skill is referenced between 5.0 and 49.0 per cent of the job postings over the 2022–2023 period. There are seven supporting AI roles: data engineers, software engineers and designers, DevOps engineers, database analysts, software developers and programmers, solutions architects, and software architects.

¹² See Appendix B for details.

¹³ Autor and others, *The Work of the Future*.

¹⁴ Tamayo and others, “Reskilling in the Age of AI.”

¹⁵ Munappy and others, “Data Management for Production Quality Deep Learning Models.”

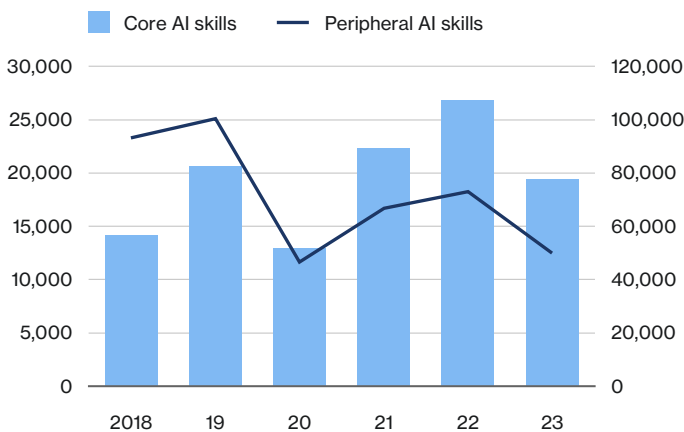
Demand for core AI skills is increasing while it is declining for peripheral AI skills

There is a shift in the Canadian AI job market toward more specialized core AI skills¹⁶ while the demand for peripheral AI skills¹⁷ is decreasing. The demand for core AI skills increased by 37.0 per cent from 2018 to 2023 with a compound annual growth rate (CAGR) of 5.4 per cent. In contrast, the demand for peripheral AI skills decreased by 46.4 per cent from 2018 to 2023 with a CAGR of -9.9 per cent. (See Chart 2.)

Chart 2

Demand for core AI skills is growing, but the demand for peripheral AI skills is declining

(left axis: # of job postings requiring at least one core AI skill; right axis: # of job postings requiring at least one peripheral AI skill)



Sources: The Conference Board of Canada; Vicinity Jobs.

The growth in core AI competency is mostly driven by increasing demand for knowledge areas such as generative AI, ML operations, model operations, AI optimization, supervised learning, and related technologies such as SageMaker, PySpark, Azure ML Studio, and PyTorch. The decline in peripheral AI competency is largely driven by decreasing demand for knowledge areas such as agile software development, software design, cloud computing, and technologies such as Java, SQL, Linux, Git, C++, Microsoft SQL Server, and Python.

The diverging trends in demand for both core and peripheral AI skills reflect the slow, but ongoing integration of AI systems and technologies into existing business operations. The growth in core AI skills requirements suggests companies are increasingly prioritizing advanced AI capabilities, focusing on specialized knowledge and skills. Conversely, the decline in demand for peripheral AI skills indicates that basic programming and data manipulation skills are increasingly being augmented by automation tools and replaced with other tools and programs.¹⁸ This trend is sometimes referred to as “cannibalization” of technology roles. AI coding assistants, low-code/no-code platforms, and generative AI for software development are minimizing the need for manual coding tasks and transforming the work of developers.¹⁹

The growth in core AI skills relative to the demand for peripheral AI skills suggests that companies are focusing on hiring specialists with advanced AI experience and upskilling their existing workforce. For graduates and employees, it underscores the importance of developing specialized AI expertise.

While the job posting data provided us with information on skills and roles in demand, our interviews with AI leaders offered additional perspectives on what businesses want from AI specialists.

16 Skills that are only and directly applicable in the context of developing and using AI technologies. There are knowledge-oriented core AI skills such as ML, neural networks, deep learning, and related technology-oriented core AI skills such as Scikit/Sklearn, PyTorch, and TensorFlow.

17 Skills that are critical to the use of AI may be used in other contexts as well. There are knowledge-oriented peripheral AI skills such as agile software development, cloud computing, data analysis, and technology-oriented peripheral AI skills such as SQL, Python, and Java.

18 Autor and others, *The Work of the Future*.

19 Peng—and others, “The Impact of AI on Developer Productivity.”

AI talent insights

Technical skills are paramount, and Canada has them in abundance

Developing technical talent is where Canada thrives. We have one of the most highly educated populations, and we made necessary investments into building up our AI workforce before many peer nations. But we cannot take our foot off the pedal, or we risk losing our competitive edge.

Our interviews with Canadian and U.S.-based AI companies highlighted that technical skills, particularly in AI and ML, are essential for candidates. They stressed that technical proficiency forms the foundation for any AI-related role, which includes expertise in ML, mathematics, and programming.

Employing technical talent, usually at the PhD or MA level, is considered table stakes for businesses to be competitive in the AI market. Organizations that cannot find candidates trained specifically in AI often find that they can hire graduates trained in hard science disciplines with modelling experience such as physicists.

Advances in AI and the changes in business models around building versus buying AI products are shifting the skills needed. Buying AI products rather than building them in-house provides benefits such as reduced costs and the reliance on a vendor whose sole focus is on that AI product. For this reason, many organizations are moving or have moved to outsourcing their AI products and programs. The skills that companies want now are often infrastructure and architecture-based, rather than purely data science alone. We heard that candidates who understand application programming interfaces (APIs) and data architecture and engineering are highly valued.

Despite abundant talent, Canada's slow adoption could limit economic benefits

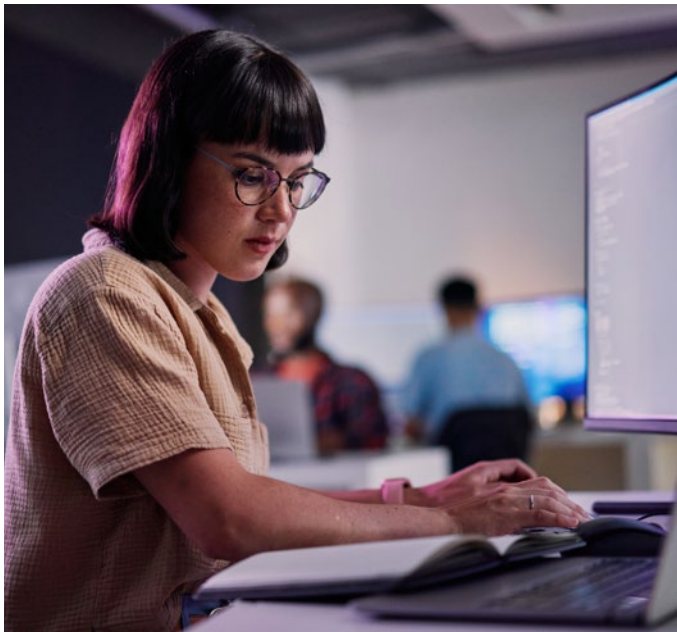
Start-ups and enterprises across the Canadian organizations we spoke to (in real estate, finance and banking, energy transportation, cybersecurity, music, fintech, HR technology, consulting, and the public sector) are receiving hundreds of applicants for positions requiring AI skills. There is an influx of AI and technology workers due to the 2022–2024 tech layoffs, graduates from AI programs, and a slowdown in the technology industry.

We heard this influx is creating several challenges for organizations. Respondents told us that the hype around generative AI (GenAI) has created an explosion of “AI enthusiasts,” who inflate their AI training and experience to apply for AI roles. Workforce needs and availability also differ depending on the size of the company, and the focus—whether it is developing AI or leveraging AI in business. Smaller companies are often looking to hire more experienced talent to navigate the technical challenges inherent to a newer business, but these people are in shorter supply than new graduates and junior AI talent. They told us they often lost bids for experienced senior talent to the U.S. due to compensation. Smaller companies also face constraints in hiring less-experienced people because they don't have the capacity to train this AI talent to be prepared for the fast-pace and many challenges a start-up faces, and the high technical capabilities due to a small team size. Thus, more senior talent is preferred.

In contrast, larger Canadian organizations in adjacent AI spaces from sectors including consulting, retail, and banking told us they have not been facing as many challenges in attracting skilled workers. They can hire junior individuals who can be trained and promoted internally. Large organizations have the means to create internal training or rotational programs to develop their AI and tech talent, which are touted by interviewees as successful for technology and new AI hires.

Large Canadian firms informed us that the salary ranges for AI talent create internal barriers to hiring. Hiring managers face constraints imposed by their HR or finance departments, as the prevailing market rates for sought-after AI specialists are often considered too high. As a result, AI hiring managers often need to persuade their organizations and justify the necessity of making these hires.

Lastly, with relatively low rates of AI adoption and a lack of business R&D in Canada, the R&D and experimentation activities that the highest echelon of AI talent want to work on are limited and may drive top prospects to tech giants south of the border. There are several factors that explain Canada's limited AI adoption and uptake in the labour force, such as insufficient competitive incentives, declining business expenditures on R&D, the cost of deploying new technologies, insufficient information about AI technologies, and a historically high degree of risk aversion.^{20,21} Counteracting these challenges will require systemic action such as an increase in competition that drives industry to experiment with new technologies and prompts new market entrants.



AI talent needs business skills and real-world experience

To stand out, AI talent needs more than just technical skills.

Finding the right mix of skills is a challenge

Interviewees in Canada and the U.S. spoke to us about the importance of an “engineering mindset” – the ability to conduct experiments and to think at the systems level. Top talent can identify which models are most appropriate to solve an issue and differentiate when GenAI should be used or when more traditional AI/ML methods are best used. This is particularly relevant when creating AI products in-house.

Companies want to hire AI talent that can think about return on investment and communicate their AI projects to decision-makers. Given the pace of change, key skills include the ability to keep pace with rapid market changes, understand new products and tools as they emerge, and adapt to evolving possibilities in the field, especially since the technology can change drastically over a few months.

There is a lack of real-world experience

We heard that businesses are looking to hire candidates with real-world business application experience. Such candidates are hard to find. Few candidates have AI training on large, business data sets. There is a strong desire for AI training institutions to draw on real-world data as part of AI talent development. This challenge is exacerbated by the influx of early-stage AI candidates who do not have real-world data training and experience and the outflows of experienced talent to the U.S. and/or to technology giants.

Multiple interviewees mentioned that ML engineers need a strong intuition about ML models to know how to deploy models from end-to-end and know when something has gone wrong. Employers are seeking candidates who can apply AI tools to build differentiated products and understand how to integrate various technologies. Data engineers play a crucial role in this ecosystem, connecting data

20 Conference Board of Canada, *The 2024 Innovation Report Card*.

21 Toronto Metropolitan University, “Automation Nation? AI Adoption.”

sources within organizations and integrating them with existing data platforms. Given the focus on adoption and deployment, AI talent will need the skills to know when AI can solve business problems. There is a clear demand from industry for a more pragmatic, industry-aware workforce. Companies want work-ready graduates who can integrate quickly and solve industry specific problems. Post-secondary institutions and AI training organizations can play a central role in driving new talent and technologies into the economy.

Universities can develop highly qualified workers, including STEM researchers who create innovative technologies and business students who can operate in complex international markets. However, universities aren't focused on training students on specific tools for industry applications. Addressing that need are colleges and polytechnics that are focused on applied knowledge and skills training. Additionally, work-integrated learning (coop, internships, academic-industry scholarships) can create a more work-ready graduate.

Business schools and other non-technical programs are integrating AI into their curricula to address demands for more well-rounded employees across disciplines, but more is needed to bridge the theory-to-practice gap of new graduates.

Cross-disciplinary training for better business solutions

Businesses are looking for AI talent with specialized training in domain-specific areas. The degree to which AI job candidates have sector-specific experience or knowledge outside of AI (for example, in health, finance, manufacturing) helps them to stand out.

Developing cross-disciplinary curriculums will give AI talent more exposure to industry or sector specific issues prior to entering the job market.

The most desired AI hires excel in non-AI skills

Creativity, curiosity, problem-solving, communication, the ability to wear many hats, and business acumen in project management, sales, customer success, and business development are what interviewees said are most desired but difficult to assess when hiring AI talent. Often these are the skills that differentiate candidates with similar technical expertise. We found no major differences between Canada and the U.S. in the importance of these non-technical skills.

AI hires need to be able to tell the story of their AI experiments and projects to decision-makers, as well as explain why they deserve funding or what specific business problems they can solve. Given that many organizations are hiring from academic research settings, there is also a desire for candidates to work well under pressure, within teams and with a sense of urgency. Interviewees felt sometimes the heavy pressures of the competitive market do not exist in academia to the same degree.

Skills that were considered the hardest to hire for include management skills, leadership skills, and vision, reflecting the early maturity phase of many candidates who are often new graduates or re-skilling into the AI field. Other skills mentioned as difficult to find include the intuition to understand models, problem-solve what has gone wrong, and have non-traditional user experience (UX) and design (for example, UX that isn't workflow based because of how AI changes human-computer interaction).

Assessing these non-technical skills is difficult. Organizations are shifting their interviewing strategy to look for these skills and aptitudes.

Leading U.S. organizations are more focused on experimentation and early adoption

Adoption of generative AI in the U.S. is double that of Canada, and most of the companies who are building advanced AI systems like OpenAI, Meta, Alphabet, and Anthropic are in the United States.²²

In the interviews with U.S. organizations, it became clear that this rapid adoption among businesses and the R&D of the world's largest companies create a different hiring environment.

These higher levels of adoption and massive investments in AI systems have created an AI talent shortage in that country. We heard of a scarcity of PhDs with strong AI skills. The scarcity was noted by one U.S.-based interviewee as being everywhere for AI/ML talent in the U.S., and the salaries offered reflect that shortage.

U.S. organizations want to see candidates from prestigious universities or with AI work experience with tech giants to know they are capable of cutting-edge AI development. Given the investments, large compensation, and freedom to experiment, these AI hubs are where we often find the deepest benches of AI talent.

According to U.S. interviewees, experimentation with AI is a critical component of advancing the field; also, finding a balance between incremental and disruptive approaches is considered essential. We heard that AI workers may spend between 70.0 and 80.0 per cent of their efforts on incremental improvements, while between 20.0 and 30.0 per cent are dedicated to transformative, disruptive experimentation. Transformative experimentation is where the top talent wants to be.

They also emphasized the need to develop systems capable of rapidly integrating and updating GenAI models upon release and anticipating rapid advancements in AI applications. Several U.S. interviewees told us they are placing a greater emphasis on buying best-in-class AI services,



alongside having employees who understand infrastructure and have API expertise, rather than purely data science skills and experience.

With these emerging trends, U.S. employers are focused on candidates who understand token limits, API usage, and throughput speeds, and have the ability to identify and solve relevant problems using AI technologies. There is a need for AI talent to know when to use AI and when simpler solutions are enough to avoid unnecessary complexity in solving business problems.

U.S.-based tech giants have also invested heavily in computational power.²³ This access to GPUs and other AI infrastructure allows talent to experiment and develop cutting-edge AI technologies. Canada's announcement of a \$2 billion investment²⁴ provides a base for AI infrastructure development, but there must be access to this AI infrastructure for students and start-ups working to build next-generation AI technology and applications.

Given the demand for AI talent in the U.S. and the higher compensation packages, competition for top-skilled workers with U.S. companies can be especially challenging for Canadian firms.

²² KPMG, "More Than One Third of Canadian Businesses Experimenting with ChatGPT."

²³ Microsoft, "Microsoft Announces the Largest Investment to Date in France."

²⁴ Innovation, Science and Economic Development Canada, "Government of Canada Launches Public Consultation on Artificial Intelligence Computing Infrastructure."

Canadian organizations emphasized non-financial benefits to attract AI talent

While competitive compensation remains a major factor in attracting and retaining top talent, Canadian interviewees emphasized non-financial benefits, such as the ability to work remotely or being mentored by a well-known AI specialist, as part of their AI recruitment strategies. Other attraction and retention tools included having a strong brand in the market, obtaining venture capital funding from a notable firm, or being named a top employer in Canada.

A company culture with leadership that is supportive of building a strong base of AI talent was also seen to drive employee referrals. These referrals reduce the burden of going to the market for talent and the time, money, and effort that this requires.

Interviewees told us that younger generations are much more interested in working in high-impact environments and contributing to solving challenging problems with real-world influence. This change in workforce motivation can make it challenging for organizations to attract in-demand AI talent, especially if their projects are interpreted as siloed or not part of a bigger picture equation.



25 Evident Insights, "Evident AI Index."

Future implications for business

GenAI is changing the AI playbook

Despite Canada's challenges with AI adoption, GenAI is changing how companies develop and implement AI. Organizations are piloting GenAI to see where it can have the most impact. Organizations are also looking more at outsourcing AI development to AI vendors who are dedicated to developing their product, which often doesn't make sense for an organization where AI is not yet a part of their business model.

Moreover, GenAI is providing individuals and organizations with new automation opportunities. Tasks that were previously too difficult or expensive to automate, or the technology was not quite able to do so, are now open to disruption. These include activities such as developing requests for proposals, writing first drafts, and developing email and marketing content. Many of the now automatable tasks are in the realm of white-collar knowledge workers, which may change the nature of work and status in the future.

Our interviews revealed that banks and insurance companies are often ahead in evaluating and implementing generative AI pilot projects, looking for optimal projects for implementation based on potential productivity and efficiency improvements while also managing risks. In fact, three Canadian banks rank in the top 20 for AI capabilities among the 50 largest banks in North America, Europe, and Asia, with Scotiabank positioned at 18th.²⁵

AI skills are changing rapidly

As AI adoption grows, the demand for ML and data scientists is expected to continue to grow. But as GenAI-powered tools enhance coding efficiency, there may be a reduced demand for software developers and software engineers.

Demand for data architecture and data engineering skills is expected to continue to grow, with a focus on creating plug-and-play solutions as companies look to buy rather than build their AI tools. Thus, professionals who can design scalable systems that integrate with AI technologies will be in high demand. Additionally, the ability to work with multi-modal AI, which can process and generate various types of data (for example, text, images, audio), is becoming an essential skill.

Critical thinking skills are evolving to include knowing when and when not to use AI. This is true for technical talent who need to discern if generative AI or more traditional (and cheaper, less computing-intensive) ML methods can solve a business problem, as well as for non-technical talent to know when and how they should turn to an LLM or AI tool for a solution. There is a growing emphasis on experimentation, as professionals need to explore and test AI and ML capabilities to solve complex problems.

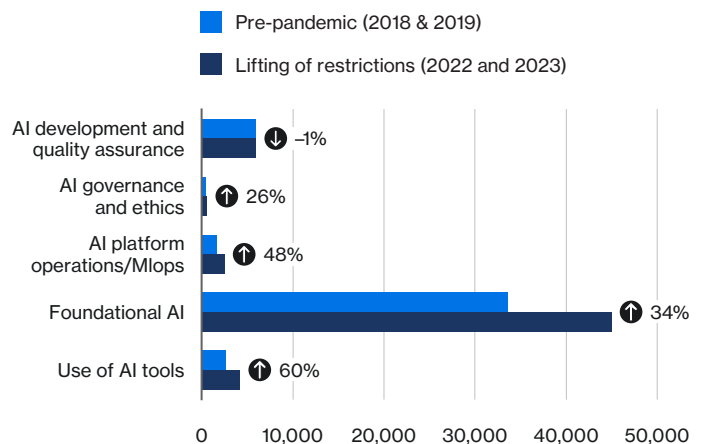
One skill mentioned regularly by interviewees is prompting, but the role for prompt engineering was seen as a flash in the pan. Instead, interviewees noted that knowing how to ask AI systems questions will be a necessary skill, which we can call “prompt design.” This skill will not require the same degree of complexity going forward, as AI systems become more powerful and help augment the prompts itself, allowing users to work with GenAI models on the best way to receive the information or data needed.

An increased focus on governance and responsible AI

The risk and governance functions are largely seen as necessary and desirable by interviewees. Companies are seeking to establish AI governance roles or processes that will help to reduce C-suite resistance and customer concerns and smooth the road for greater AI adoption. Many large AI-adjacent organizations already have departments or roles dedicated to this. Smaller AI-first and adjacent organizations are saying they are actively involved in discussions in this area and will hire specific individuals for this function in the future. While job postings asking for skills in AI ethics and governance are still minimal, they have increased by 26.0 per cent between pre-pandemic (2018 and 2019) and the lifting of COVID-19 restrictions (2022 and 2023).²⁶ (See Chart 3.)

Chart 3

Skills associated with foundational AI skills and the use of AI tools experienced the largest growth (# of job postings requiring different categories of core AI skills; percentage change)



Sources: The Conference Board of Canada; Vicinity Jobs.

²⁶ See Conference Board of Canada, The, “AI skills taxonomy online publication (forthcoming).”

U.S.-based interviewees said an advantage of working or having worked on AI projects at the tech giants is that these organizations have had AI governance policies and teams, in some cases, for over a decade. Employees and alumni have experience in building privacy, security, and transparency into their models, and they have corresponding experience in having their projects reviewed and approved by lawyers and technical individuals who make up offices that evaluate AI projects on these merits.

Even if companies don't have roles dedicated to AI risk or governance, interviewees mentioned that their technical leads are heavily involved in this area. Businesses are also looking for assurances such as a warranty to certify the performance of a system (especially in risky applications), regulations to ensure bias doesn't get baked in, and chokepoints or gates to ensure the development of safe systems.

The development of this area is critical because having trust in AI systems correlates with ease and speed of widespread AI adoption.

AI moves into the C-suite

It is not AI talent that makes the decision to invest in AI; it's the C-suite. Educating the executive team about the business opportunities created by AI is paramount.

At the highest levels of organizations, the C-suite is expected to continue adapting to include positions specifically focused on AI and data science. The emergence of roles such as chief AI officers and chief data scientists, especially in banking and insurance, reflects the strategic importance of AI in driving business decisions.

Canada also has an AI trust issue. Given how low trust in AI is compared to peer nations,²⁷ it is imperative for the C-suite and boards of directors to not only have a high degree of AI literacy but also to be able to impart trust and knowledge of the technology to their customers, employees, and the public more generally. Typical ways of doing this include robust change management, AI governance implementation, and strong privacy and cybersecurity measures.

Organizations seek to integrate AI solutions that solve business problems

Large organizations in industries outside of technology are rapidly piloting GenAI to transform operations and tasks based on efficiency and cost savings. Smaller technology companies are also adopting co-pilots and encouraging their engineers to look for ways that AI can augment their own operations. The impact of AI co-pilots is being felt across both technical and non-technical teams with tools like GitHub Copilot, LLMs, and Microsoft's Copilot being deployed across departments.

One area of development that was not discussed in our Canadian interviews is the emergence of agentic AI, which are AI agents that can act or execute on a person's behalf. These systems are not yet widely deployed, but there is sentiment that such agents may soon begin scaling up in the market. If widely deployed, these systems would reorient the internet, filtering information directly to a given user. The capabilities of such agents would dramatically change search engines and search engine optimization.

Another point we heard in U.S.-based interviews was the strong need to build systems to quickly integrate the most state-of-the-art GenAI models as they get released. This approach is driven by the recognition that the AI landscape is evolving at an unprecedented pace. While current development might focus on existing capabilities, interviewees noted that in less than six months, AI models are likely to become significantly more powerful, with vastly expanded token context windows, making the current solutions being built obsolete unless they can keep up with these changes.

The strategy of staying closely aligned with the best available models or state-of-the-art AI technologies is particularly crucial for AI-first companies. These organizations will take on the responsibility of monitoring and integrating the latest advancements, allowing AI-adjacent organizations that buy these tools and focus on their core business without the burden of keeping up with the rapidly changing AI field.

²⁷ Edelman Trust Institute, "2024 Edelman Trust Barometer."

An increased focus on AI literacy and continuous upskilling

AI tools are expected to be used by an increasing number of employees. Whether through chatbots or virtual assistants, AI will provide an augmentation and assist function for many employees.

AI literacy will allow a broader range of employees to feel confident in applying these tools. Company-wide education about AI, from the C-suite to all employees, is seen as a central issue in advancing Canada's lagging AI adoption and in increasing trust.

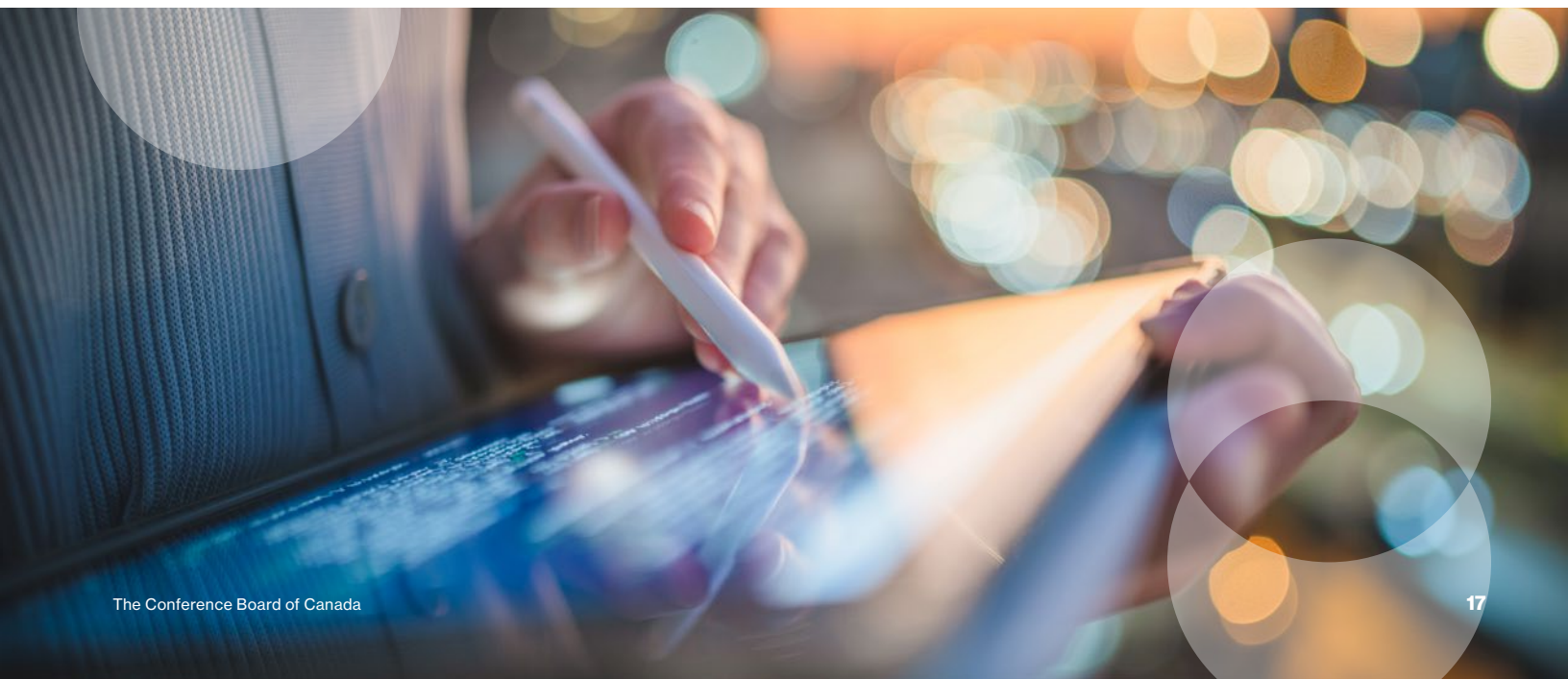
Such cross-functional integration of AI expertise is becoming essential for organizations to fully leverage AI capabilities across different operations. As a result, interviewees shared that there is an expectation of a rise in AI generalists who can effectively operate new AI tools while understanding their business implications across functions.

As AI becomes more integral to business operations, professionals who fail to adapt and incorporate these tools into their workflows may fall behind their peers who can effectively and safely utilize AI tools and platforms. We heard that AI tools may increase the productivity of senior professionals and result in fewer junior positions or entry-level opportunities in various sectors. This trend underscores the growing importance of AI literacy across various job functions.

We didn't hear that people expected massive job disruptions with these changes. Many organizations want to keep a human-in-the-loop as they apply AI as part of a commitment to AI safety. Interviewees were repeatedly optimistic in their outlook. We heard that as AI takes on more tasks, people will be able to engage in more meaningful work, ultimately bringing greater joy and satisfaction to the workplace.

Not enough organizations are thinking about how AI will disrupt their business model and reason for existence over the next five to 10 years.

Americans we spoke to place a greater emphasis on the transformative impact of AI on roles and believe that they will cause significant change in the job market. Several interviewees mentioned that AI adoption is necessary and envisioned a day when they perform better than humans in areas like medicine and personalized learning.



Strategies to retain Canada's AI talent

Recruitment strategies for AI talent

Organizations seeking to attract top AI talent are employing a variety of strategies with a strong emphasis on building relationships with post-secondary institutions. We heard that companies are focusing on tech-oriented universities in Canada such as the University of Toronto and the University of Waterloo.

One of the advantages of the high-calibre AI research field in Canada is that it creates a talent magnet. Several organizations we spoke to said that having a prominent AI specialist who is well-known in the field has helped them attract additional AI talent to their organization.

These relationships are cultivated through multiple channels including active participation in job fairs and campus recruitment events. Additionally, companies are fostering informal relationships with professors and instructors, or professors who work in industry, to develop a talent edge by recruiting students.

Beyond academic partnerships, companies are leveraging Canada's Global Talent Stream through Immigration, Refugees and Citizenship Canada. This program is designed to help Canadian businesses quickly access highly skilled foreign workers in technology fields. Organizations are also turning to specialty IT recruitment firms and agencies that focus specifically on contracting AI talent, tapping into their expertise and networks to find qualified candidates.

Companies are also showcasing their AI work at industry events, creating buzz and raising their profile among potential candidates. One key aspect of attracting top AI talent is demonstrating that the work offered is both unique and impactful. By highlighting the challenging and important nature of their AI projects, companies aim to appeal to ambitious young graduates and professionals who are seeking opportunities to make a significant impact.

Internship programs have emerged as a crucial component of AI recruitment strategies. These programs offer students practical experience and provide companies with an opportunity to assess potential future employees in a real-world setting. Partnerships with AI-focused institutions like MILA, Vector, and AMII, along with talent programs such as MITACS and leading post-secondary institutions, are providing access to specialized talent pools.

In contrast to these Canadian examples, several hiring practices used by U.S.-based interviewees were not mentioned by Canadian interviewees. This includes the use of part-time or fractional executives to provide AI support, hiring AI advisors that are based abroad, and hiring AI teams based entirely abroad.





Recommendations

To maintain Canada’s position as an AI talent powerhouse, we recommend that government, industry, and post-secondary institutions focus on the following:

Keep producing technically solid AI specialists for R&D

Given the need for strong technical skills in AI, Canadian post-secondary institutions should continue their efforts in advanced AI research programs to produce top-tier AI talent since AI talent is Canada’s largest and pre-existing advantage in the global race to adopt AI.

Renew the focus on producing business R&D

Canadian businesses need to renew R&D efforts and reverse the 20-year slump in business R&D spending.²⁸ More opportunities for AI R&D and experimentation in Canadian corporate environments would help develop top-tier AI talent, drive revenues, increase Canada’s innovation capacity, as well as provide a place for our most advanced talent rather than seeing them move abroad.

Expand work-integrated learning opportunities to build greater connections

Internships, work-integrated learning, co-ops, and other opportunities to bring students into workplaces will create in-demand AI talent, help provide exposure to real-world data, and provide business with a larger AI workforce to solve business problems.

Governments and businesses can also work with post-secondary institutes to introduce students to large datasets and the full lifecycle of an AI application. Building these connections can also help foster agility in curriculum and provide an incentive for post-secondary institutes to keep up with fast-paced AI technology changes within industry.

²⁸ Conference Board of Canada, The, 2024 Innovation Report Card.



To advance AI adoption in Canada, we recommend the following:

Educate and engage the C-suite on AI adoption

Focus on educating C-suite executives because they are the ones that determine adoption. People currently making decisions about AI adoption tend not to be AI experts. Help the C-suite understand the importance of data privacy, security, and responsible AI use for a better return on AI investments. Foster resilience and continuous learning, especially in such a fast-changing technology landscape, so that executives and decision-makers are versed in the ethical and practical implications of AI.

Establish robust AI governance structures in order to promote trust in AI

To overcome C-suite resistance, customer concerns, and advance AI adoption, companies need to establish AI governance structures that address ethics, security, and privacy concerns.

Foster rapid adoption and testing of AI models

Given the speed of technological change and the need to increase adoption in Canada, AI talent would benefit from greater access to affordable AI infrastructure to help develop, refine, and tune more advanced models. Promote the use of industry tools, particularly open source, in AI educational programs so that students are able to keep pace with the latest AI technology.

Expand cross-disciplinary programs in AI

AI talent needs to be well-rounded with cross-disciplinary experience and business skills. This will allow them to better generate ideas, sell solutions to the C-suite, and identify how AI applications can solve business and industry challenges. Expanding cross-disciplinary programs between AI/technology departments and non-technology disciplines in areas such as health and finance can help find solutions to real-world problems using AI.

Integrate AI as a core subject across all disciplines

Both AI literacy and basic technical competencies in AI should become a mandatory credit across multiple disciplines. Thus, all of the brightest minds in Canada will be better positioned to consider the potential applications of AI in their field.

Appendix A

Methodology

About this research

This research is part of the AI Talent Insights project, which is aimed at gathering targeted insights from industry to refine and enhance its AI talent development initiatives. The study involves conducting qualitative interviews with senior technical leads from Canadian and U.S. organizations to gain detailed perspectives on current and emerging hiring needs in the AI field. This project includes identifying challenges in recruiting for key AI roles and assessing skills gaps.

Research design and methods

We adopted a cross-sectional research design to develop a comprehensive understanding of the current and future demand for AI roles and skills in Canada.

In-depth interviews, roundtables, expert opinions, and analysis of job market data (Vicinity Jobs) were leveraged to gain insights into AI skills profile in AI-first and AI-adjacent organizations.

First, we conducted in-depth interviews of 46 senior technical leaders from both Canadian and U.S. organizations operating in the AI and data science space. The organizations were categorized based on different stages of business development and organizational growth.

- large enterprises with over 500 employees, indicating established and extensive operations;
- scaling companies with 20 to 499 employees, highlighting their growth and expansion phases;
- start-ups with as few as three or six employees, representing early-stage ventures

The recruitment methodology for interviews involved an initial reach out by Vector Institute to partner organizations, followed by The Conference Board of Canada's confirmation of participation and extended outreach to meet targets.

In Canada, we conducted a total of 31 interviews, representing 16 AI-first organizations and 15 AI-adjacent organizations, achieving a participation rate of 48.5 per cent from the 64 organizations contacted. In the U.S., we conducted 15 interviews, including six AI-first organizations and nine AI-adjacent organizations. The interviewee profile encompassed roles such as heads of data science, chief AI officers, managing directors of enterprise data and AI, co-CEOs, and chief scientists. These leaders represented diverse industries, including finance and banking, energy, transportation, cybersecurity, music, fintech, HR technology, consulting, real estate, and the public sector.

The interviews revolved around identifying key and emerging AI roles, associated skills, and recruitment challenges in Canadian and U.S. organizations across various sectors in the AI and AI-adjacent space. Broad areas explored during the interviews were:

- understanding current AI use and needs around how organizations are currently using AI, the specific tasks for which AI is being developed or utilized, and the roles involved in these processes;
- identifying skills related to AI that are required to accomplish various tasks, including technical skills (like ML, data analysis, natural language processing proficiency) and soft/non-technical skills that are essential for these roles;
- assessing the organization's current hiring needs for AI-related roles, including the types of roles, their functions, required skill sets, and the volume of hiring;
- exploring AI tools and platforms being used by the organization and whether specialized skills are needed to manage these tools;
- exploring how advances in AI might change the organization's operations and its future hiring needs (for example, which current roles might become obsolete, and the skill sets required for future roles);
- understanding the organization's recruitment strategies for AI talent, the success and challenges of these strategies, and the competition for AI talent;
- examining how organizations stay updated on advancements in AI, which is crucial for continuous improvement and staying competitive.

The interview transcripts were reviewed to evaluate the responses, understand the underlying themes, and identify any emerging trends. We adopted an inductive approach to computer-assisted qualitative data analysis using NVivo. This approach allowed us to identify and develop themes directly from the data. We refined and adjusted the codes and conducted analysis iteratively until saturation was reached. This process ensured comprehensive exploration of the interview transcripts. Overall, there were 2,202 minutes of interviews, with transcripts consisting of 606 pages made up of 307,003 words generated out of this research.

For the quantitative analysis, we leveraged Vicinity's job market national dataset to develop an AI skills taxonomy. Over a six-year period between 2018 and 2023, we reviewed 16,979,859 job postings in collaboration with Vicinity Jobs and identified 456,379 job postings requiring core or peripheral AI skills. We also examined 240,888 job postings to present trends for 13 AI-related roles (six critical and seven supporting AI roles).

First, we developed a preliminary list of AI skills and AI-centric roles based on the job postings data, literature review, and interviews. Third, we searched the final sample of job postings for “unique mention of a given skill” and then categorized AI-skills, technologies, and competencies into the six mutually exclusive categories. Fourth, we developed two sets of clusters: occupation-centric skills clusters; and skill-centric skills clusters.¹ A full data and skills taxonomy will be available as a data briefing and an online tool for employers, students, post-secondary institutions (PSIs), and training programs.

Finally, we validated our findings through two roundtables comprising experts from industry and academia. The groups also included representatives from prominent organizations in both the AI-first and AI-adjacent sectors. These discussions offered a collaborative platform to refine and enrich the findings from the interviews and job market data, leveraging the collective expertise of participants to enhance the credibility, depth, and applicability of this qualitative analysis.

¹ See Conference Board of Canada, The, “AI skills taxonomy online publication (forthcoming).”

Appendix B

Detailed tables

Table A1

Number of job postings for critical and supporting AI roles

Role	2018	2019	2020	2021	2022	2023	2022–2023	CAGR	2018–2023
AI/ML scientists/researchers	121	142	54	87	87	47	–46%	–14.6%	–61%
21231.00D - ML Ops engineers	171	244	97	149	139	63	–55%	–15.3%	–63%
60010.00C - Technical product managers	210	394	323	490	392	292	–26%	5.6%	39%
12113.00A - Statistical officers and related research support occupations	20	33	36	48	71	94	32%	29.4%	370%
41402.00A - Business intelligence analysts	210	163	118	207	215	167	–22%	–3.7%	–20%
21211.00A - Data scientists	1,149	1,692	1,189	1,685	2,035	1,210	–41%	0.9%	5%
Critical AI roles subtotal	1,881	2,668	1,817	2,666	2,939	1,873	–36%	–0.1%	0%
21211.00B - Data engineers	2,272	2,710	1,195	1,537	1,599	1,240	–22%	–9.6%	–45%
21231.00A - Software engineers and designers	12,259	15,114	5,738	8,446	8,137	3,798	–53%	–17.7%	–69%
21231.00C - DevOps engineers	2,219	2,931	1,329	1,509	1,456	824	–43%	–15.2%	–63%
21223.01A - Database analysts	4,643	4,815	3,270	6,013	7,461	5,015	–33%	1.3%	8%
21232.00A - Software developers and programmers	28,223	30,436	9,520	10,092	9,434	7,018	–26%	–20.7%	–75%
21222.00C - Solutions architects	2,618	2,731	1,144	1,576	1,513	1,104	–27%	–13.4%	–58%
21231.00B - Software architects	3,995	3,869	2,249	2,187	2,194	1,611	–27%	–14.0%	–60%
Supporting AI roles subtotal	56,229	62,606	24,445	31,360	31,794	20,610	–35%	–15.4%	–63%
Economy total (all roles)	2,635,139	2,757,830	2,038,614	2,808,399	3,660,890	3,078,987	–16%	2.6%	17%

CAGR = compound annual growth rate

Sources: The Conference Board of Canada; Vicinity Jobs.

Table A2**The top 10 core AI skills that experienced the most growth in demand**

(# of job postings requiring a particular skill, with skills sorted by the absolute difference in job postings between the two periods)

Skill	Skill subgroup	2018 and 2019	2022 and 2023	Change (%)
PySpark	AI development and quality assurance	187	719	284.5
MLops	AI platform operations/Mlops	0	472	N/A
ModelOps	AI platform operations/Mlops	0	411	N/A
PyTorch	AI development and quality assurance	496	743	49.8
Generative AI	Foundational AI	0	192	N/A
Sagemaker	AI development and quality assurance	37	222	500.0
MLflow	AI platform operations/Mlops	0	75	N/A
AI optimization	AI platform operations/Mlops	48	120	150.0
Dataiku	Use of AI tools	32	82	156.3
LLMs (Large language Models)	Foundational AI	0	48	N/A

N/A: not applicable

Sources: The Conference Board of Canada; Vicinity Jobs

Table A3**The top 10 peripheral AI skills that experienced the most decline in demand**

(# of job postings requiring a particular skill, with skills sorted by the absolute difference in job postings between the two periods)

Skill	Skill subgroup	2018 and 2019	2022 and 2023	Change (%)
Agile software development	Project management and process design	61,281	27,991	-54.3
Java	Software design, development, and quality assurance	50,115	17,885	-64.3
SQLw	Data storage, transformation, and retrieval	56,304	30,075	-46.6
Linux	DevOps	26,868	7,912	-70.6
Software design	Software design, development, and quality assurance	29,403	11,375	-61.3
Git	Software design, development, and quality assurance	27,919	10,161	-63.6
Cloud computing	DevOps	39,300	23,731	-39.6
C++	Software design, development, and quality assurance	23,419	7,983	-65.9
Microsoft SQL server	Data storage, transformation, and retrieval	21,206	7,506	-64.6
Python	Software design, development, and quality assurance	32,305	18,995	-41.2

Sources: The Conference Board of Canada; Vicinity Jobs.

Appendix C

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